Microbial challenges – contamination and aftergrowth

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Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

The 10th Nordic

DRINKING WATER CONFERENCE

Reykjavík, September 28–30 2016

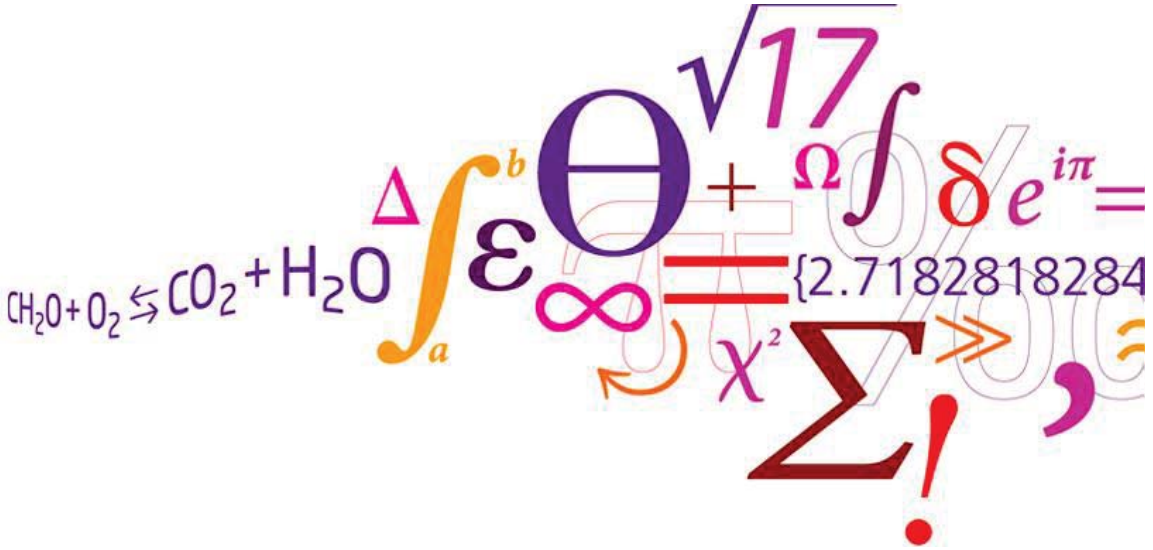
PROGRAM

NDWC NORDIC DRINKING WATER CONFERENCE

Workshop 4
Cooperation in research and development in the Nordic countries

Microbial challenges – contamination and aftergrowth

Hans-Jørgen Albrechtsen



NDWC NORDIC DRINKING WATER CONFERENCE

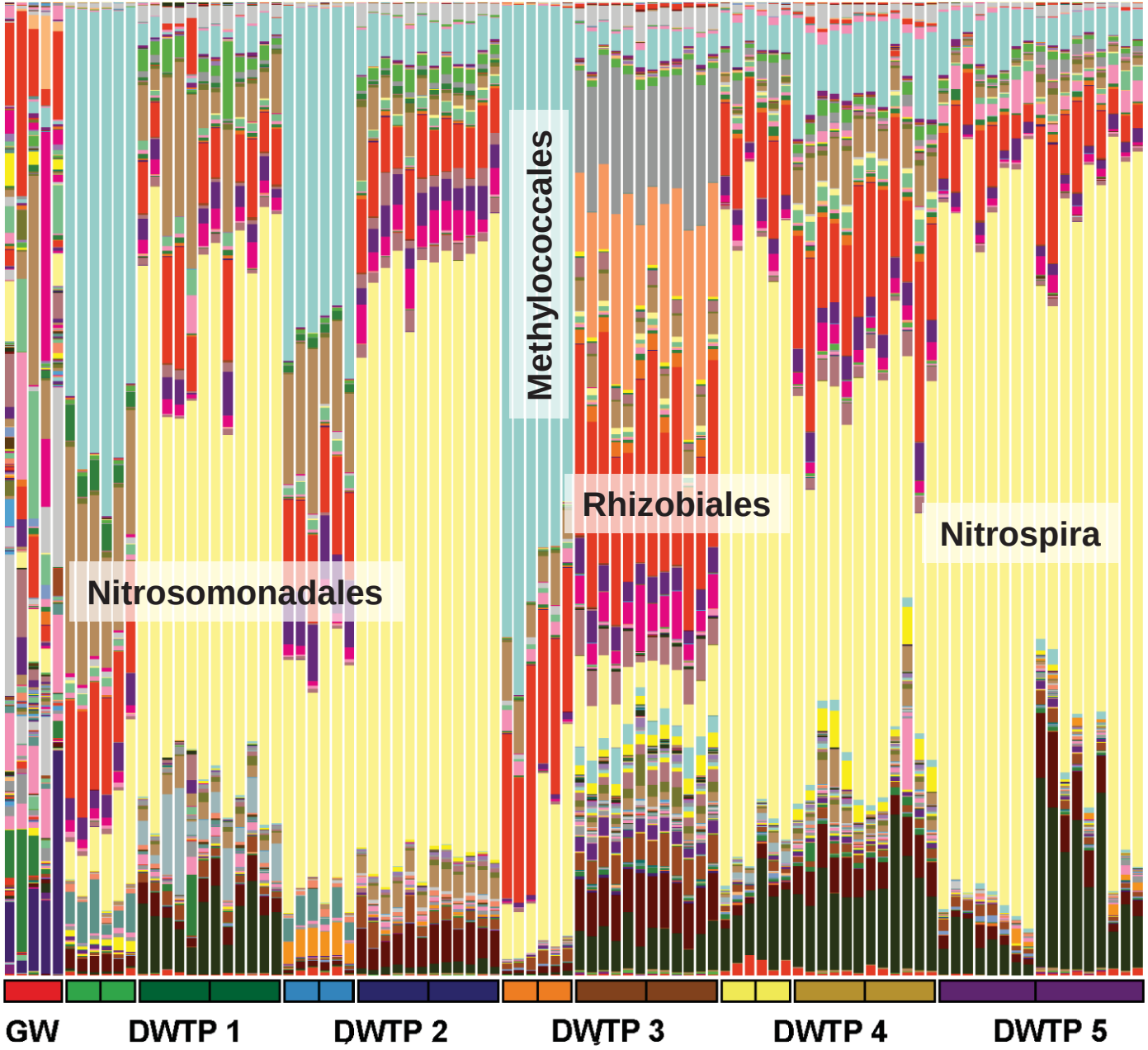
The 10th Nordic
DRINKING WATER CONFERENCE
Reykjavík, Iceland, September 28–30 2016

DTU Environment
Department of Environmental Engineering

Cooperation in research and development in the Nordic countries

- Search for common problems / challenges
- Topics at this conference
  - Measuring methods
  - Risk assessments / water safety plans
  - Lack of compliance in microbial quality at small water works
  - Biofilm
  - Disinfection
- Rapid development in microbial methods
  - Virus
  - Genomics – full genome sequencing
- Important input to risk assessment – QMRA
- Microorganisms dominant risk in water supply

Microbial communities
Filter material - Pyrosequenzing



- Nitrospira-Nitrospirales
- Gammaproteobacteria-Methylococcales
- Alphaproteobacteria-Rhizobiales
- Betaproteobacteria-Nitrosomonadales
- Acidobacteria-Cand. chloracidobacterium
- Acidobacteria-Da023
- Alphaproteobacteria-Caulobacterales
- Deltaproteobacteria-Gr-wp33-30
- Deltaproteobacteria-Desulfurellales
- Planctomycetacia-Planctomycetales
- Acidimicrobiia-Acidimicrobiales
- Betaproteobacteria-Burkholderiales
- Om190-Uncultured_bacterium
- Gammaproteobacteria-Xanthomonadales
- Deltaproteobacteria-Myxococcales
- Anaerolineae-Anaerolineales
- Alphaproteobacteria-Sphingomonadales
- Chlamydiae-Chlamydiales
- Gammaproteobacteria-Pseudomonadales
- Halobacteria-Halobacteriales
- Gemmatimonadetes-Bd2-11_terrestrial
- Gemmatimonadetes-Gemmatimonadales
- Alphaproteobacteria-Rhodospirillales
- Actinobacteria-Corynebacteriales
- Cytophagia-Cytophagales
- Deltaproteobacteria-Bdellovibriona
- Thermoleophilia-Akiw543
- Caldilineae-Caldilineales

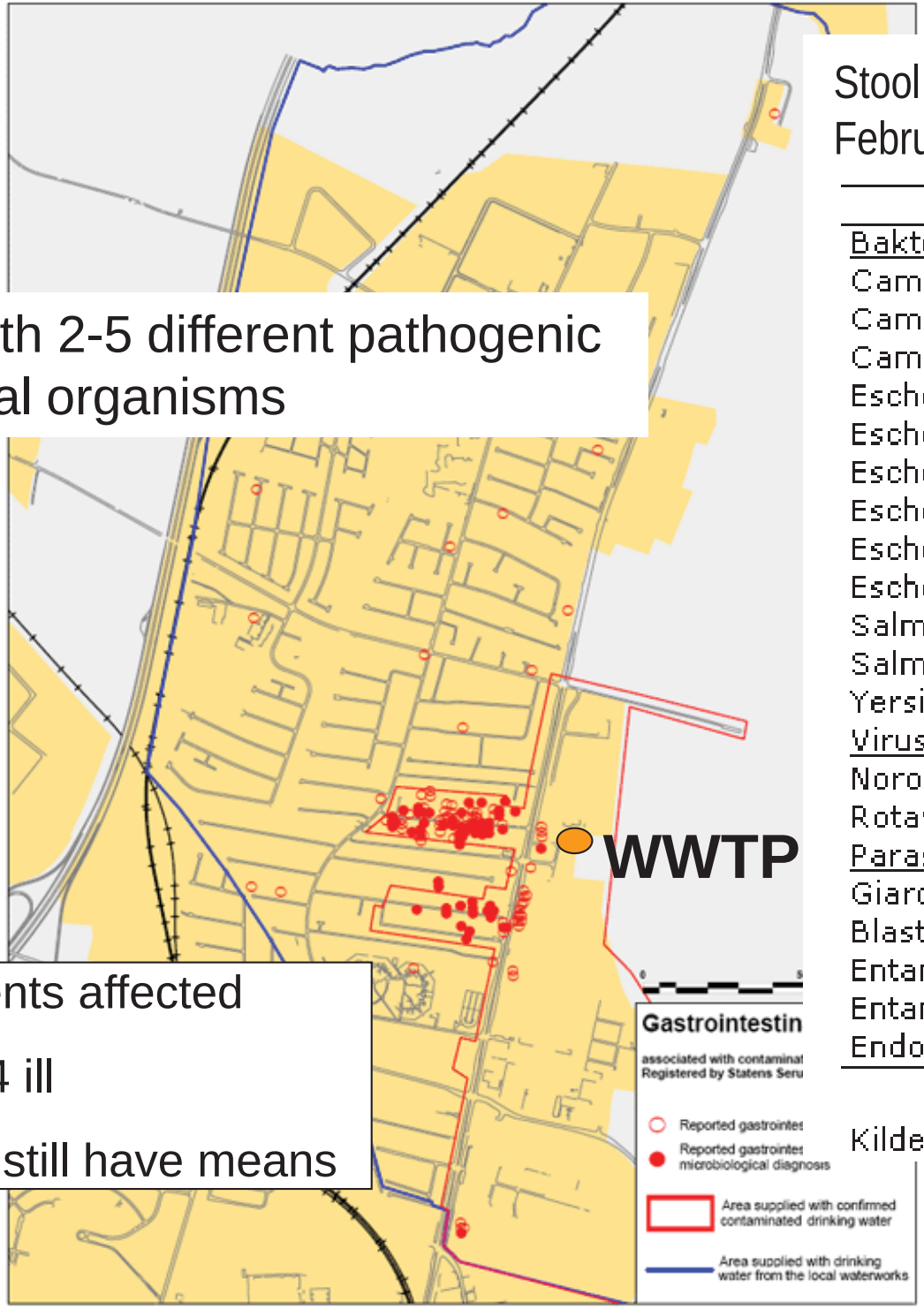
Gülay, A., Musovic, S., Albrechtsen, H-J., Al-Soud, W. A., Sørensen, S. J. & Smets, B. F. (2016) ISME Journal. 10:2209–2222

Køge 2007

23 patients with 2-5 different pathogenic gastrointestinal organisms

15. Jan. 2007

- 3. april 2007



7,000 citizents affected

At least 224 ill

Approx. 40 still have means

Stool samples from patients, end of February 2007

	N
Bakterie	
Campylobacter jejuni	16
Campylobacter coli	4
Campylobacter lari	3
Escherichia coli (A/EEC)	15
Escherichia coli (EPEC O55)	1
Escherichia coli (EPEC O119)	3
Escherichia coli (EPEC O128)	1
Escherichia coli (ETEC LT)	1
Escherichia coli (VTEC VT1+VT2)	1
Salmonella Stanley	2
Salmonella Senftenberg	1
Yersinia enterocolitica	1
Virus	
Norovirus	32
Rotavirus	3
Parasit	
Giardia intestinalis	4
Blastocystis hominis	12
Entamoeba histolytica/dispar	1
Entamoeba coli	6
Endolimax nana	2

Kilde: EPI-NYT uge 10, 2007

Vestergaard et al. Outbreak of severe gastroenteritis with multiple aetiologies caused by contaminated drinking water in Denmark, January 2007. Euro Surveill 2007;12(3):E070329.1.
http://www.eurosurveillance.org/ew/2007/070329.asp#1

Biofilm samples – hot water

Galvanized steel

Diam: 16 mm

28 days

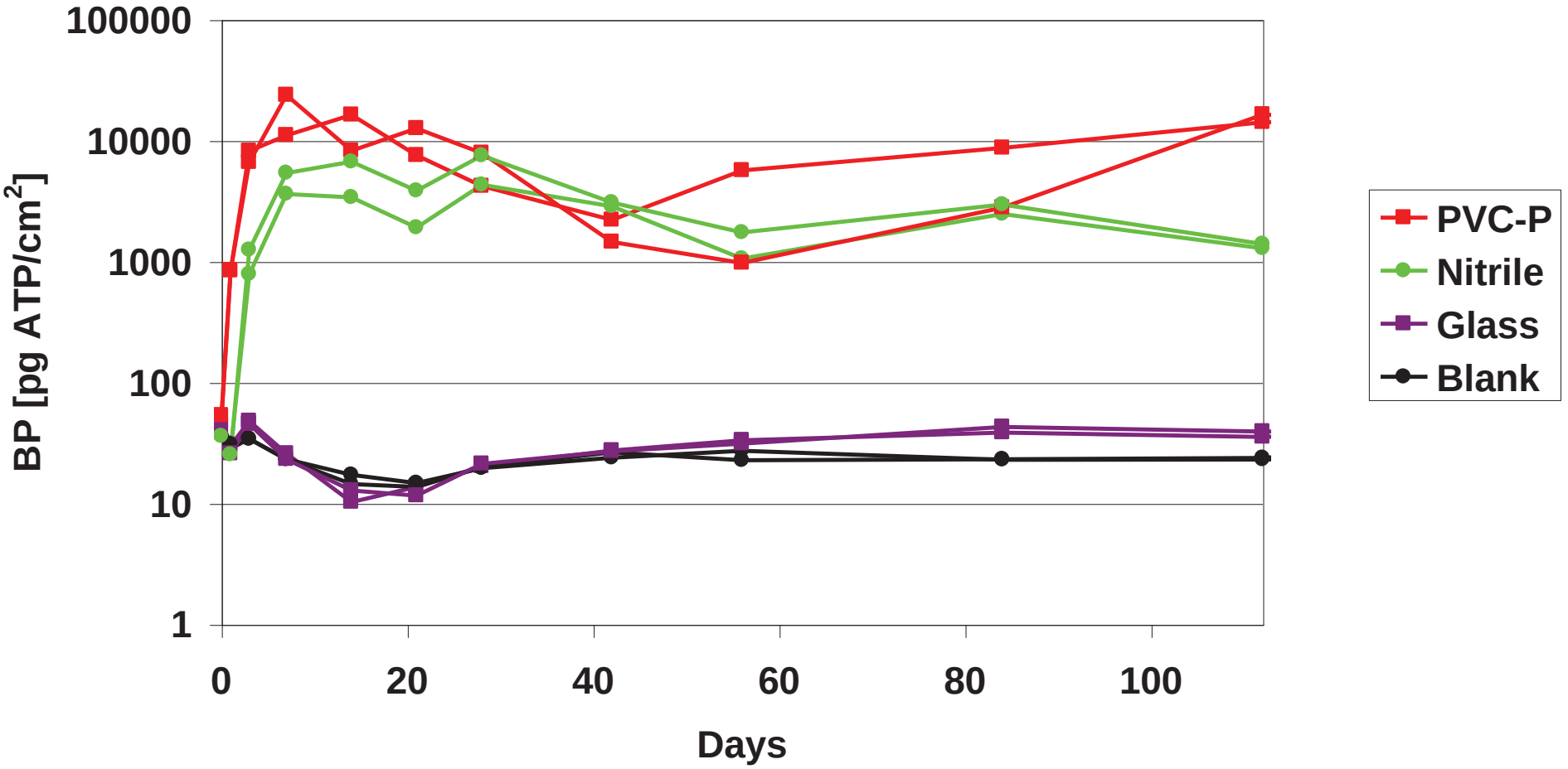
Hot water tank

L.K. Bagh et al., 1999, Biofouling 14 p. 37-47

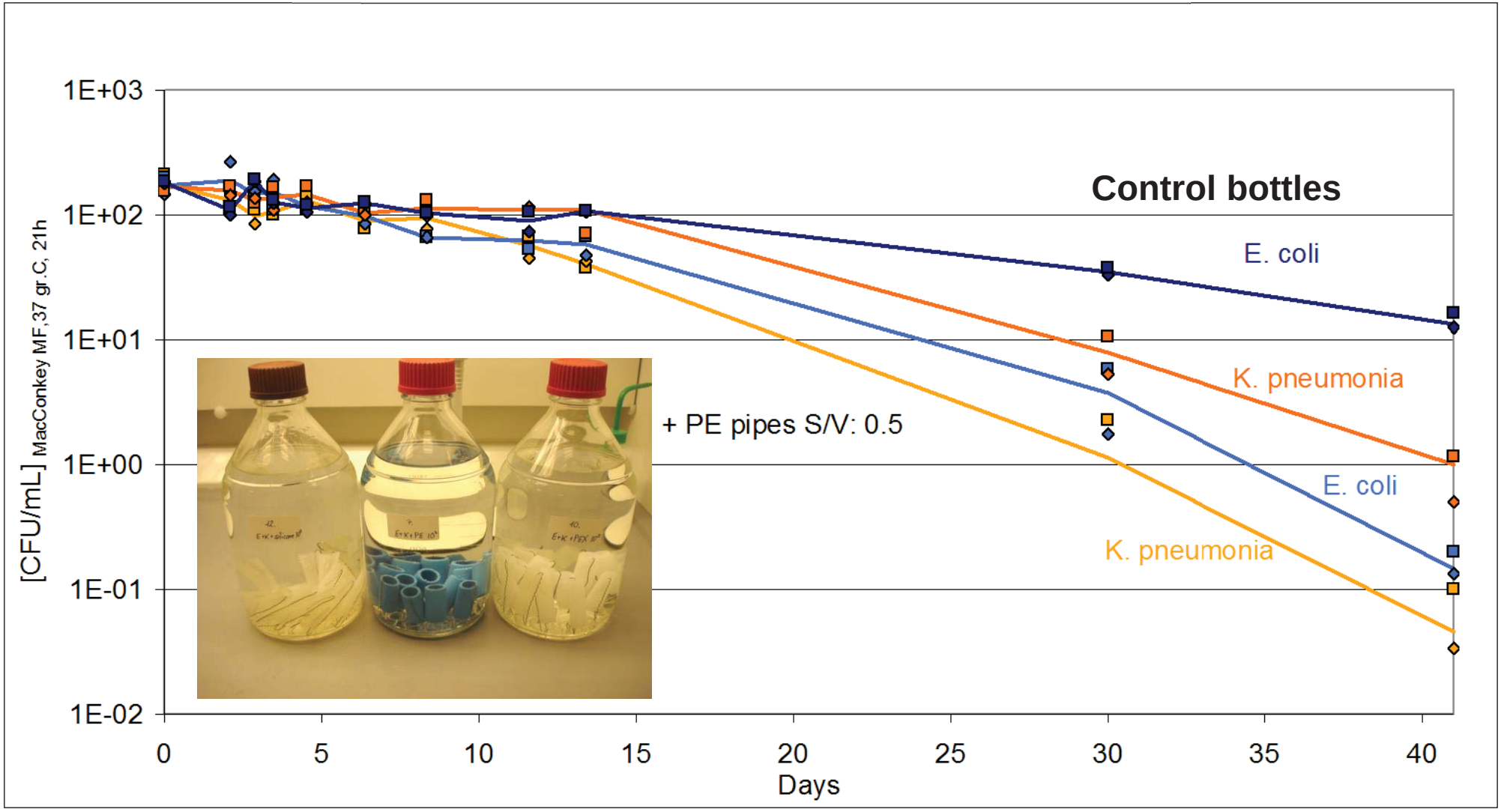
Microbial growth at materials in water supply

Development over time

25° C, S/V ~ 0.17 cm^{-1}, water exchange 1 x /week



K. pneumonia, E. coli (ATCC 25922) survival in contact with plast pipes



Topic's

- Aftergrowth in the network
  - Interaction with materials (PE, rubber…)
  - Formation of biofilm
- Emerging pathogens?
- Survival and behavior of pathogens or indicators in the distribution network
  - Interaction with biofilm
  - Interaction with sediment in the distribution system